







# Approaches to Land Zoning on the Basis of Sustainable Territory Development

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**Abstract.** One of the basic approaches to land use is their differentiated (separate) use, which is implemented through the division of land by main purpose into categories and the introduction of land zoning. Under the purpose of a particular land is proposed to understand the method of its operation (use) for a specific purpose in accordance with the zoning of land, as well as the legal regime of the relevant category of land. Land zoning is a way to ensure the use of land for various social needs, in which the purpose is set not for one land plot, but for a group of adjacent plots that form a functional zone. The owner of the land has the right to choose its intended use within the list of types of targeted land use established for a specific functional area. The zoning should be based on such classification features as the distribution of land by category, the suitability of land for use in economic sectors, the suitability of agricultural soils for growing crops, the composition of landscape complexes and land, the need for certain land in certain lands, legal status of lands.

**Keywords:** Land planning · Land zoning · Sustainable land use · Purpose of land · Land suitability

## 1 Introduction

The unique importance of land resources in the livelihood of society is determined by their effective management, especially when there is an intensive process of formation of land relations of a new type. The development of various forms of land ownership, the formation of a ranked economy necessitate the improvement of land management based on land zoning, the essence of which is their differentiated use. In Ukraine, the principle of land zoning is defined by the Land Code of Ukraine, which states that land zoning is carried out within settlements and sets requirements for permissible types

of development and other land use within individual zones in accordance with local building regulations [1].

As for lands outside settlements, the problems of their zoning in Ukraine still remain without due attention. Although in many countries of the world land zoning and determining on this basis their long-term use, taking into account a range of environmental, economic, social, historical and other factors has long been widely used in the practice of territorial development management. The experience of European countries shows the prospects and effectiveness of this.

Thus, Larsson Gerhard identified trends in addressing the issues of adaptation of the territory to difficult conditions and finding methods to ensure efficient use of land and other natural resources. During the twentieth century, we have witnessed the very active development of legal instruments for this purpose, aimed at managing spatial planning and implementation of plans in accordance with the chosen goals and policies [2].

Hall Thomas researched the planning process of large cities, the problems that arose during their development, and analyzed the impact of individual design decisions on the development of their development [3].

It is obvious that these studies are acceptable for the conditions of Ukraine.

The issue of land zoning in Ukraine is the subject of scientific works of domestic scientists such as Berladin O., Ibatullin Sh., Loik G., Martyn A., Novakovska I., Perovich L., Tretyak A. etc.

Berladin O. considers land zoning as a necessary condition for creating in Ukraine an effective mechanism for determining the distribution of land by their categories and types of land use within administrative-territorial entities and the implementation of effective state management of land use and protection [4].

Ibatullin Sh. Developed a conceptual model of mechanisms of land relations development in the context of balanced use, protection and reproduction of land resources as a component of spatial socio-economic development, and proved the need for innovative forms of land use management due to environmental constraints on land use [5].

Loik G. substantiated the methodology of functional zoning of territories when updating the master plans of villages in order to increase the efficiency of land use [6].

According to Martyn A., the introduction of organizational and methodological approaches to defining the boundaries of administrative-territorial units in Ukraine and land zoning can be an important prerequisite for streamlining the territorial organization of our state, the proper functioning of the tax system, the introduction of effective maintenance of state land cadastre and register of real property rights [7].

Novakovska I. considers the features of forecasting, planning and design of airports in the context of ecological and efficient land management. Scientists have proposed a detailed plan for zoning aerodromes and substantiated the principles of zoning the area around the aerodrome in combination with the aerodrome and land use [8]. In addition, Novakovskaya proved that satellite data is an important part of the information needed for sustainable use of nature, assessment of the impact of economic activities of ecosystems, identification of risks associated with loss of landscape and biotic diversity [9].

Perovych L. believes that cadastral zoning of lands is one of the important components of creating a cadastral system of Ukraine, which contributes to the creation of an attractive investment climate and identifying priority areas for sustainable economic development of territories. These issues are not fully resolved for lands outside settlements. The cadastral zoning of lands should take into account the requirements of European and international standards for classification and codification of the administrative-territorial structure of the state, types of economic activity [10].

Tretyak A. defined the conceptual basis of land zoning for the management of land resources outside settlements and substantiated the essence of land zoning as a land management process for the formation of the legal regime and land regulation of land use [11].

However, many aspects of the research problem have not been studied both methodologically and practically. Some of them are debatable and require further research and justification. Determining the criteria and methods of allocating territorial zones, their classification and impact on improving the management of land use and protection remains one of the important factors of environmentally friendly land use.

## 2 Methodology

The methodology of research of the problem of land zoning determines that the subject of research is the principles of land zoning through their differentiated use in market land relations. In the process of research the methods of abstract-logical, economic-statistical and monographic are used, with the help of which the zoning of lands for substantiation of ecologically safe land use is substantiated.

## 3 Results and Discussion

The implementation of a differentiated approach to land use is carried out through the division of land into categories according to the main purpose and the introduction of land zoning. Given that this activity, according to the requirements of the time, will be significantly adjusted, this approach will be a reliable basis for the introduction of new methods of land use management and protection.

We consider land as the basis on which economic activity takes place on the basis of the right to land, which complies with current legislation. In this regard, we highlight the following features of land use as an object of management:

- land is an integral part of natural resources;
- land is a product of nature, its fertility is determined to a greater extent human activity;
- land is used inseparably from other natural resources;
- rational use of land can be carried out only taking into account natural, political, economic, social and other conditions;
- land plots have qualitative and quantitative individual properties;
- land use should be differentiated, conditioned soil-climatic and territorial conditions;
- land use should be accompanied by an increase in its productive power.

The Land Fund of Ukraine suffers from many negative environmental and economic factors due to the unreasonableness of establishing targeted land use. The issue of improving the mechanism of land management needs to be addressed to increase the efficiency of land use and reproduction in the context of environmentally friendly land use [12].

The solution to the problem of land use optimization is seen in the improvement of methodological approaches to establishing targeted land use and determining the optimized structure of land for the use of zoning tools.

Ecological and economic model of sustainable development in land use of Ukraine in the medium term, which reflects the ratio of different groups and categories of land, in terms of regions are given in Table 1.

Implementation of its main methodological provisions will optimize the structure of Ukraine's land fund and form sustainable land use, which is a prerequisite for rational and productive use of land resources in various sectors of the economy and increase the production of environmentally friendly agricultural products.

As already mentioned, the problems of land zoning outside settlements have long been left without proper attention. Although land zoning (zoning) is a very good alternative to the system of land use. Zoning is a way to ensure the use of land for various social needs, in which the purpose is not set for one plot of land, but for a group of adjacent plots that form a functional area. Each functional zone has a specific generalized purpose, for each of which is established not one purpose, but a certain set of permissible land use. Therefore, the owner of the land has the right to choose its use within the list of types of land use, established for a specific functional area. The principles of land zoning should be the basis for land use in accordance with their intended purpose.

We offer the following basic principles for land zoning [13]:

- zoning should be carried out taking into account the landscape structure of the territory and the qualitative characteristics of the land;
- ensuring environmental priorities of land use;
- taking into account the existing buildings, transport and engineering infrastructure, as well as special elements of the urban structure within the settlement, ensuring its reconstruction and development on the basis of rational nature management and resource conservation.;
- definition for each territorial zone (subzone) of land management regulations, which establish a set of types and conditions of land use, as well as their permissible changes;
- establishment of the legal regime for each territorial zone in the calculation of its application equally to all land plots located within its boundaries;
- linking the boundaries of zones with the boundaries of major land holdings and land uses;
- the amount of territorial units allocated for zoning should correspond to the area of dismembered land in the individual type of zoning or volume in the case of typological zoning;
- the features on which the division of land is carried out (whether territorial units are classified) must be such that each point (territorial unit) falls into only one of the selected categories;
- the classification feature may vary from one degree of zoning to another.

**Table 1.** Ecological and economic model of sustainable development in land use of Ukraine in the medium term in terms of regions

No.	Region	Total area, thous. ha	Functional type of environment, thous. ha / %										for construction and location of objects of economy branches of economy (building)
			agro-landscape		total	environment stabilizing			of them		water		
			total	of them arable		forests and other forested lands	open wetlands	water					
1	Vynnytsia	2649,2	1925,0 / 72,7	1600,4 / 60,4	569,7 / 21,5	391,6 / 14,8	29,5 / 1,1	43,0 / 1,6	154,5 / 5,8				
2	Volyn	2014,4	952,6 / 47,3	561,9 / 27,9	889,8 / 44,2	727,6 / 27,9	116,8 / 5,8	45,4 / 2,3	172,0 / 8,5				
3	Dnepropetrovsk	3192,3	2427,8 / 76,1	2003,1 / 62,7	485,5 / 15,2	212,8 / 6,7	26,9 / 0,8	155,8 / 4,9	279,0 / 8,7				
4	Donetsk	2651,7	1913,5 / 72,2	1492,7 / 60,1	351,8 / 13,3	234,9 / 8,8	10,3 / 0,4	41,4 / 1,6	386,4 / 14,5				
5	Zhytomir	2982,7	1535,5 / 51,5	997,5 / 33,4	1241,3 / 41,6	1110,5 / 37,2	82,5 / 2,8	48,3 / 1,6	205,9 / 6,9				
6	Transcarpathian	1275,0	430,0 / 33,7	169,2 / 13,3	742,6 / 58,2	723,3 / 56,7	1,0 / 0,1	18,3 / 1,4	102,7 / 8,1				
7	Zaporozhye	2718,3	1982,9 / 72,9	1588,9 / 58,5	393,6 / 14,5	141,9 / 5,2	6,7 / 0,2	172,0 / 6,3	341,8 / 12,6				
8	Ivano-Frankivsk	1392,7	588,9 / 42,3	323,7 / 23,2	742,1 / 53,3	643,8 / 46,2	2,6 / 0,2	23,7 / 1,7	61,7 / 4,4				
9	Kyiv	2812,1	1582,1 / 56,3	1237,7 / 44,0	963,7 / 34,3	740,5 / 26,3	49,4 / 0,2	173,8 / 6,2	266,3 / 9,4				
10	Kirovograd	2458,8	1955,0 / 79,5	1672,2 / 68,0	343,7 / 14,0	193,9 / 7,9	10,4 / 0,4	75,7 / 3,1	160,1 / 6,5				
11	Luhansk	2668,3	1832,9 / 68,7	1263,1 / 47,3	530,7 / 19,9	393,9 / 14,8	16,4 / 0,6	22,0 / 0,8	304,7 / 11,4				
12	Lviv	2183,1	1156,9 / 53,0	656,0 / 30,0	758,3 / 34,7	706,2 / 32,2	9,5 / 0,4	42,6 / 2,0	267,9 / 12,3				
13	Mykolayiv	2458,5	1935,5 / 78,7	1604,9 / 65,3	351,8 / 14,3	138,3 / 5,6	20,9 / 0,6	127,4 / 5,2	171,2 / 7,0				
14	Odessa	3331,3	2407,2 / 72,3	1825,4 / 54,8	732,3 / 22,0	246,7 / 7,4	72,8 / 2,2	211,5 / 6,3	191,8 / 5,7				
15	Poltava	2875,0	2064,1 / 71,8	1593,9 / 55,4	649,9 / 22,6	295,3 / 10,3	85,8 / 3,0	148,3 / 5,2	161,0 / 5,6				
16	Rivne	2005,1	843,3 / 42,1	503,9 / 25,1	984,2 / 49,1	834,7 / 41,6	107,3 / 5,4	42,2 / 2,1	177,6 / 8,8				
17	Sumy	2383,2	1655,8 / 69,5	1184,9 / 49,7	581,6 / 24,4	462,6 / 19,4	62,0 / 2,6	30,6 / 1,3	145,8 / 6,1				
18	Terнопil	1382,4	975,5 / 70,6	760,0 / 55,0	285,4 / 20,6	208,2 / 15,1	4,9 / 0,4	19,4 / 1,4	121,5 / 8,8				
19	Kharkiv	3141,8	2322,0 / 73,9	1834,4 / 58,4	650,5 / 20,7	439,0 / 14,0	30,6 / 1,0	60,3 / 1,9	169,3 / 5,4				
20	Kherson	2846,1	1842,6 / 64,7	1594,2 / 56,0	794,0 / 27,9	181,9 / 6,4	31,6 / 1,1	433,3 / 15,2	209,5 / 7,4				
21	Khmelnytsky	2062,9	1446,5 / 70,1	1102,3 / 53,4	441,1 / 21,4	298,4 / 14,5	21,1 / 1,0	39,8 / 1,9	175,3 / 8,5				
22	Cherkasy	2091,6	1344,0 / 64,3	1124,6 / 53,8	627,5 / 30,0	346,4 / 16,6	28,9 / 1,4	135,9 / 6,5	120,1 / 5,7				
23	Chernivtsi	809,6	401,6 / 49,6	250,2 / 30,9	344,6 / 42,6	261,0 / 32,2	1,2 / 0,1	18,5 / 2,3	63,4 / 7,8				
24	Chernihiv	3190,3	2050,0 / 64,3	1305,3 / 40,9	923,0 / 28,9	736,4 / 23,1	119,1 / 3,7	67,5 / 2,1	217,3 / 6,8				
25	Autonomous Republic of Crimea	2608,1	1693,9 / 64,9	1006,8 / 38,6	680,4 / 26,1	332,7 / 12,8	4,9 / 0,2	216,7 / 8,3	233,8 / 9,0				
26	Kyiv	83,6	5,0 / 6,0	0,5 / 0,6	43,4 / 51,9	36,4 / 43,5	0,3 / 0,4	6,7 / 8,0	35,2 / 42,1				
27	Sevastopol	86,4	26,1 / 30,2	10,3 / 11,9	37,2 / 43,1	36,3 / 42,0	- / -	0,9 / 1,0	23,1 / 26,7				
	In general in Ukraine	60354,8	39296,2 / 65,1	29268,0 / 48,5	16139,7 / 26,8	11075,2 / 18,4	953,4 / 1,6	2421,0 / 4,0	4918,9 / 8,1				

Therefore, the classification features of zoning are important. After all, the correct selection of certain features essentially determines the content and depth of land zoning. The proposed features of land zoning are: distribution of land by category, suitability of land for use in industries, suitability of agricultural land for growing crops, the composition of landscape complexes and land, the need for certain land in a particular land, legal status of lands, etc.

When zoning lands in Ukraine, it is proposed to single out the following system of taxonomic units: zones of the 1st order (groups of lands); zones of the 2nd order (types of lands); zones of the 3rd order (subtypes of lands); zones of the 4th order (types of lands); zones of the 5th order (land plots). In the practical implementation of the principle of land zoning, the proposed name of “zones of different order” can be clarified. For example, more well-established taxonomic unit names may be suggested: zone, province, county, subdistrict, district, subdistrict, locality, area, and so on.

Land zoning should be carried out in different detail, ie at the national, regional and local levels, with differences in tasks and mechanisms of practical application. Specific land zoning options depend on many factors: the existing land use system, the natural structure of landscapes, historical heritage, social goals, and so on.

In terms of land zoning are graphically indicated:

- boundaries of zones (groups of lands, categories, types of land use, etc.), defined for agricultural and forestry activities, housing and public buildings, nature reserves and environmental activities, recreational, health, historical, cultural and water activities, industry, transport, so-called communications, energy, defense and other purposes;
- boundaries of lands in respect of which restrictions on their use apply;
- boundaries of drinking water sources;
- boundaries of lands for soil dumps, earthworks and extraction of local minerals of local significance;
- land boundaries for measures to protect, preserve and improve the quality of the upper fertile soil layer, environmental protection and landscape;
- boundaries of especially valuable agricultural lands and forest lands.

In accordance with the proposed classification features, we conducted zoning of lands of Kyiv region which are shown in Fig. 1.

Zones of the 1st order (groups of lands): agro-landscape, environment-stabilizing and residential (building).

Thus, zoning of lands by types of land use is land management actions on the division of land into types and subtypes of land use depending on the ecological and economic suitability of land, the value of other natural resources - outside settlements and urban and natural resource value of land and other natural resources - within settlements.

Land zoning is most effective when a set of interrelated criteria and approaches is used to allocate zones. Naturally, the fewer zones and the larger the area of each, the better to achieve such a comprehensive and effective zoning.

When assessing the effectiveness of a land zoning system, it is proposed to use four main criteria: functional, environmental, economic, social (according to the interests of different groups). The last two criteria in practice can not always be clearly separated and then they are combined into a single socio-economic criterion.

From the standpoint of environmental efficiency in the same functional area should include areas similar in their environment-forming or environmental function. For example, the territory of one watershed, the habitat of certain, the most valuable in terms of conservation species and communities, etc., which is important for the preservation and implementation of the functions of an ecosystem. Sometimes such areas, which are part of a single ecosystem (for example, a watershed), are partially found outside the zone. These external areas form an area to which the community seeks to extend its influence and where it interacts with local and regional governments. According to the existing legislation, this zone should be granted the status of a protection zone.

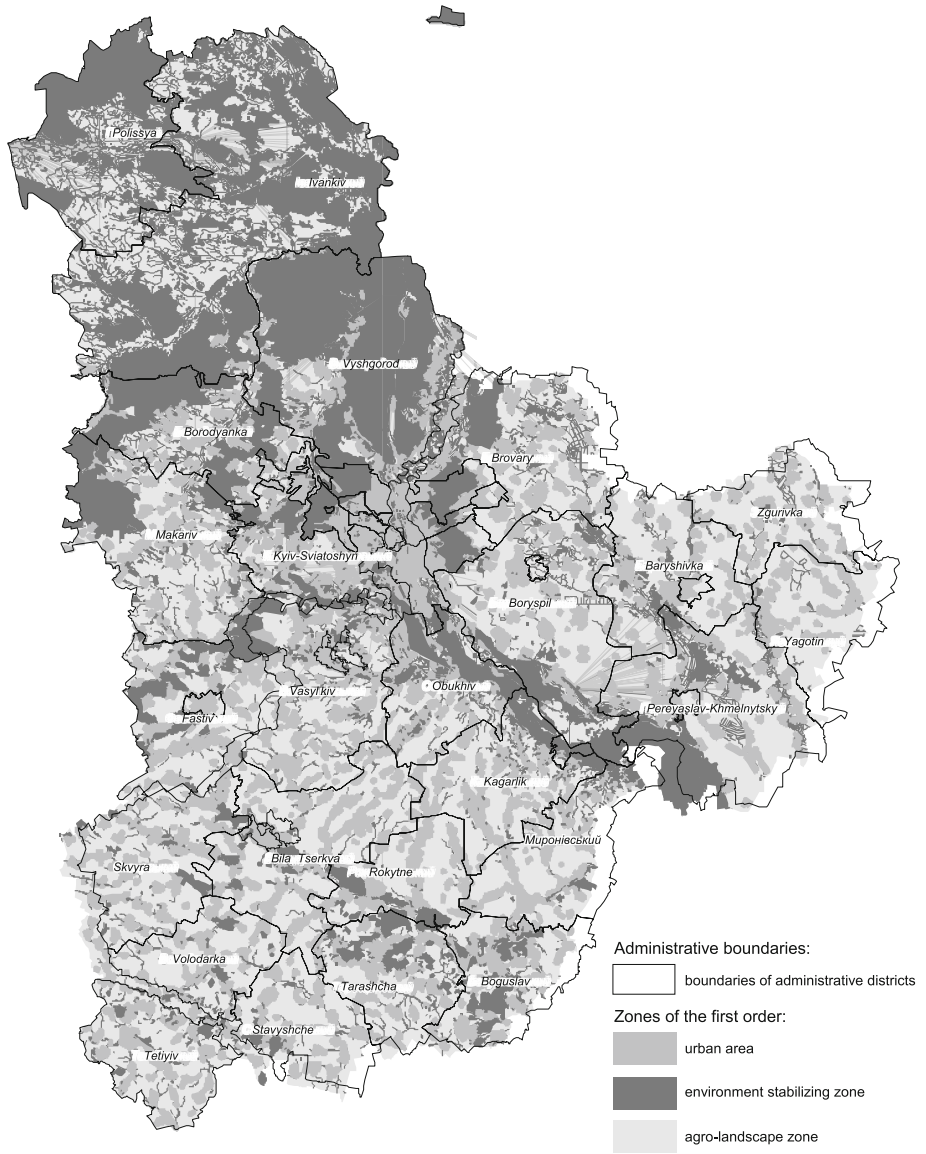
In addition, the zoning of land (by their categories) outside the settlements should be understood as land management and legal actions, in addition to the division of land by type and subtype of land use within the ecological and economic suitability of land [14].

As for economic and social efficiency. The value of zoning of lands on which economic activity is carried out (or will be carried out in the future) is to combine different types of nature management and management without conflict (Table 2).

In order to make a profit is now used the principle of efficient use of land resources. Thus, the application of the principle of the most efficient use of land is provided - it is physically possible and economically feasible use of land and (or) land improvements in accordance with the law [15].

Constant fluctuations in land prices lead to other changes in land use due to constant pressure on existing land use and contribute to the reconstruction of property, which includes dilapidated buildings or structures. Prices remain highest in the most accessible areas around the city center and transport corridors, and the density in these areas continues to grow. In proportion to the development of the city, there is a tendency to increase land prices throughout the city (Table 3).

Therefore, it is important that zoning meets the requirements of efficiency in the load of interests and the nature of land use, ie based on existing boundaries of lands, settlements and administrative and economic entities.



**Fig. 1.** Geoinformation modeling of zoning of the Kyiv region with the allocation of first-order zones



**Table 2.** Average annual income from land use by purpose\*

Administrative-territorial unit and separate territory	Average annual income from the use of land for its intended purpose, UAH/ha							
	agricultural land	lands of nature reserves and other nature protection purposes	health-improving lands	recreational lands	lands of historical and cultural significance	forestry lands	water fund lands	land for industry, transport, communications, energy, defense and other purposes
1	2	3	4	5	6	7	8	9
Autonomous Republic of Crimea (except for the South, South-East and West coasts)	1070	5371	6171	5143	6243	7034	1246	13714
Southern coast of the Autonomous Republic of Crimea	2048	8057	13029	10857	6243	14069	2491	13714
South-Eastern coast of the Autonomous Republic of Crimea	1275	8057	7714	6429	6514	8441	1868	13714
West coast of the Autonomous Republic of Crimea	898	5371	9257	7714	6243	10551	1868	13714
Vinnitsya region	914	537	1371	1143	3257	4111	753	12000
Volyn region	715	4297	1543	1286	3529	3003	1016	14571
Dnipropetrovsk region	776	806	1029	857	1900	8286	446	16857
Donetsk region (except the Azov coast)	850	806	1200	1000	1357	9320	360	18571
Azov coast of Donetsk region	986	1074	2057	1714	1357	11184	539	18571
Zhytomyr region	560	3223	1714	1429	1900	2968	462	18000
Transcarpathian region	627	9131	51433	4286	3800	1278	1016	13429
Zaporozhye region (except the Azov coast)	818	537	1200	1000	2171	14337	905	16571
Azov coast of Zaporozhye region	825	269	2057	1714	1357	15771	1357	16571
Ivano-Frankivsk region (except mountain and foothills)	689	7520	2400	2000	4071	1399	736	13429
Mountain and foothills of Ivano-Frankivsk region	508	13429	4286	3571	4071	3497	883	13429
Kiev region	831	1343	1714	1429	2171	3629	755	16286
Kirovograd region	777	537	1029	857	1357	9091	723	10571
Luhansk region	607	537	1029	857	1086	6777	360	14857
Lviv region (except mountain and foothills)	615	1611	2400	2000	8414	2999	665	16571
Mountainous and foothill part of Lviv region	392	13429	4286	3571	8414	7498	798	16571
Mykolaiv region (except the Black Sea coast)	658	537	1886	1571	1086	13806	905	13429
Black Sea coast of the Nikolaev area	872	537	2571	2143	1086	15186	1357	13429

(continued)

**Table 2.** (continued)

Administrative-territorial unit and separate territory	Average annual income from the use of land for its intended purpose, UAH/ha							
	agricultural land	lands of nature reserves and other nature protection purposes	health-improving lands	recreational lands	lands of historical and cultural significance	forestry lands	water fund lands	land for industry, transport, communications, energy, defense and other purposes
1	2	3	4	5	6	7	8	9
Odessa region (except the Black Sea coast)	728	1611	2057	1714	1086	8103	1163	25429
Black Sea coast of Odessa region	931	1880	2571	2143	1086	12154	1745	25429
Poltava	853	806	1543	1286	1629	7457	755	13143
Rivne region	746	1074	1714	1429	2171	2816	555	14000
Sumy region	690	537	1543	1286	2171	4013	679	12286
Ternopil region	783	1880	1886	1571	3529	4730	753	11714
Kharkiv region	767	806	1371	1143	1900	5251	562	18000
Kherson region (except the Black Sea and Azov coasts)	882	2149	2057	1714	1629	9560	905	14286
Black Sea and Azov coast of Kherson region	928	5371	2571	2143	1900	11472	1357	14286
Khmelnysky region	879	537	1371	1143	3257	3981	753	12286
Cherkasy region	1012	537	1886	1571	2443	4297	985	12571
Chernivtsi region (except mountain and foothills)	886	2149	2229	1857	3257	1320	736	17429
Mountain and foothill part of Chernivtsi region	612	5371	4286	3571	3257	3301	883	17429
Chernihiv region	589	3223	2400	2000	3257	3199	616	13429
m. Kyiv	1151	9756	8979	7483	9441	21494	2822	46216
Sevastopol and administrative-territorial units that are part of it	2959	5371	6171	5143	6243	9200	850	19714

\*Developed according to the data adopted in accordance with the Methodology for determining the amount of damage caused by unauthorized occupation of land, use of land for other purposes, removal of soil cover (fertile soil layer) without special permission.

**Table 3.** Average annual income from the use of land for housing and public buildings by purpose according to the group of settlements by population\*

Groups of settlements by population, thousand people	Average annual income from the target use of land for housing and public buildings, UAH/ha
To 0,2	4026
From 0,2 to 1	5636
From 1 to 3	7247
From 3 to 10	8052
From 10 to 20	12883
From 20 to 50	20130
From 50 to 100	24156
From 100 to 250	28182
From 250 to 500	32208
From 500 to 1000	40260
From 1000 and more	56364

\*Developed according to the data adopted in accordance with the Methodology for determining the amount of damage caused by unauthorized occupation of land, use of land for other purposes, removal of soil cover (fertile soil layer) without special permission.

## 4 Conclusion

The main features of land use as an object of management are their belonging to natural resources, determining the effective fertility of human activities, inseparable from other natural resources use, the presence of land qualitative and quantitative individual properties, differentiated nature of use due to soil and climatic and territorial conditions, etc.

To solve the problem of land use optimization, it is necessary to improve methodological approaches to establishing targeted land use using land zoning tools.

The zoning should be based on such classification features as the distribution of land by category, the suitability of land for use in economic sectors, the suitability of agricultural soils for growing crops, the composition of landscape complexes and land, the need for certain land in certain lands, legal status of lands.

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